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PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to Cementing Compositions

We, BRITISH GEON LIMITED, of Devonshire House, Mayfair Place, Piccadilly, London, W.1, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved cementing composition, and in particular to Portland Cement compositions incorporating synthetic copolymer materials.

It is well known that polymeric materials may be incorporated in Portland Cement compositions in order to improve the physical properties such as mechanical strength. The polymer is typically added in the form of a latex, although other forms can be employed, and commonly used polymers include polyvinyl acetate, copolymers of styrene and butadiene, and copolymers which include vinylidene chloride. It is the purpose of this invention to provide cement compositions of good properties.

It is an object of the present invention to provide economical cementing compositions incorporating copolymers, which compositions when cured are of good mechanical properties, particularly with respect to tensile strength and bond strength.

Accordingly the present invention is a cementing composition comprising Portland Cement, and from 5 to 40 parts by dry weight per 100 parts of Portland Cement of one or more terpolymers in latex form, wherein said terpolymers are derived from units of butadiene, styrene and acrylonitrile and wherein each terpolymer contains from 5 to 60% by dry weight of acrylonitrile units and the ratio of styrene units to butadiene units is from 1:8 to 8:1 by weight.

Any of the usual commercial Portland cements used for manufacture of mortar or concrete can be used in this process. The composition may also include aggregates which may be any of those commonly used in concrete or mortar compositions, for example, sand, gravel, quartz sand or lime. The usual ratio of cement to aggregate is 1:3 by weight but ratios of up to 1:8 are common. Such ratio is not critical.

It is preferable to mix the cement and aggregates (if included) together first, followed by the required amount of copolymer latex which may include an antifoaming agent. When the latex has been mixed in, water can be added to give the required consistency of the mix. Any of the known mortar or concrete additives for example setting accelerators or retarders, and wetting agents, may be added with or before the latex addition. The total amount of water added is not critical (including that in the copolymer latex) but generally ranges from 25 to 70% by weight of cement.

The mortar or concrete can then be cured. Best results are obtained with the compositions of the present invention if these are air-cured. However, water-curing may be employed for certain purposes as some properties of the final product are still improved whilst others are equal to those of non-latex containing concretes or mortars.

The terpolymer may be prepared by polymerisation of the comonomers in aqueous emulsion in a manner well known in the art. It is preferred to use emulsifiers which render the latex stable to cement and the usual aggregates. Non-ionic emulsifiers such as alkyl phenyl ethers of a polyoxyethylene glycol are particularly useful for this purpose and form at least the major amount by

weight of the emulsifier used. These emulsifiers can be incorporated in the polymerisation stage or as post-polymerisation additives or both. The total amount of non-ionic emulsifier present may range from 3 to 10% of the weight of copolymer but is preferably about 7%.

Examples of uses for the compositions of the present invention include brick-mortar, (strengthening the bond between the mortar and the bricks) patching of old cement or concrete, and laying of concrete floors where flexibility is required.

The present invention will further be understood by reference to the following Examples in which all parts given are by weight.

EXAMPLE 1

An aqueous copolymer latex of 40% w/w solids content was made by emulsion polymerising the above monomers in the following proportions:—

butadiene	35 parts
acrylonitrile	30 parts
styrene	35 parts

The total amount of non-ionic emulsifier present in the final latex was 7.5% of the copolymer weight. A small amount of Antifoam Emulsion RD (a 10% solids emulsion of a polydimethylsiloxane liquid) was included (0.75% of the copolymer weight). Several mortars were prepared of varying composition as shown in Table 1. Tensile strength specimens were made from these compositions using standard B.S. 12 tensile briquette moulds of 1" square central cross-section. The specimens were cured for 24 hours at 23°C and 95% relative humidity and then were:—

Either (i) exposed to air at 23°C for 7 days at 65—75% relative humidity
(ii) immersed in water at 23°C for 7 days.

After the curing periods the specimens were tested for tensile strength and the results were as shown in Table 2.

A further mix was prepared for assessment of bond strength.

TABLE 1

	Parts by Weight				
Composition Number	1	2	3	4	5
Portland Cement	100	100	100	100	100
Local Zone 2 Concreting and passed 14 mesh (B.S. 410)	300	300	300	300	300
Latex (40% solids)	Nil	30	37.5	45	30
Total Water	59	38	35	34	46
Copolymer/cement ratio	Nil	0.12	0.15	0.18	0.12

TABLE 2

	Parts by Weight			
Composition Number	1	2	3	4
Tensile Strength 7 day dry cure psi	249	357	354	395
Tensile Strength 7 day wet cure psi	206	176	235	249

Composition 5 was tested for bond strength, and was found to record 90 p.s.i. for the air cured composition. By comparison, composition 1, containing no latex, had zero bond strength.

EXAMPLE 2

An aqueous copolymer latex of 40% solids content was made by emulsion polymerising the following proportions of monomers by weight:—

butadiene	50
acrylonitrile	30
styrene	20

The total amount of non-ionic emulsifier present in the final latex was 9.0% of the copolymer weight. 3.5% of Antifoam Emulsion RD based on the copolymer weight was included.

Tensile/Mix Data:	Parts by Weight 1	2
Portland Cment	100	100
Sevenoaks sand passed 14 mesh (B.S.410)	300	300
Latex (40% solids)	Nil	30
Total water	67	50
Copolymer/cement ratio	Nil	0.12

	1	2
Tensile strength 7 day dry cure psi	179	270
Tensile strength 7 day wet cure psi	225	233

The composition quoted for this example has the advantage of giving a latex which is stable to freeze-thaw conditions. This is established by subjecting a sample of the latex to 5 cycles of freezing at −15°C and thawing at +25°C. This treatment produced no coagulation in the latex.

WHAT WE CLAIM IS:—

1. A cementing composition comprising Portland Cement, and from 5 to 40 parts by dry weight per 100 parts of Portland Cement of one or more terpolymers in latex form, wherein said terpolymers are derived from units of butadiene, styrene and acrylonitrile and wherein each terpolymer contains from 5 to 60% by dry weight of acrylonitrile units and the ratio of styrene units to butadiene units is from 1:8 to 8:1 by weight.

2. A cementing composition as claimed in claim 1 wherein the composition also includes aggregates.

3. A cementing composition as claimed in claim 2 wherein the aggregates are sand, gravel, quartz sand or lime.

4. A cementing composition as claimed in either one of claims 2 or 3 prepared by admixture of the cement and aggregates followed by addition of the latex.

5. A cementing composition as claimed in any one of the preceding claims wherein the latex contains an anti-foaming agent.

6. A cementing composition as claimed in either claim 4 or 5 containing mortar or concrete setting accelerators or retarders, and wetting agents added to the composition with or before the addition of the latex.

7. A cementing composition as claimed in any one of the preceding claims containing water in amount (including that in the copolymer latex) between 25 and 70% by weight of the cement.

8. A cementing composition as claimed in any one of the preceding claims wherein the terpolymer is prepared by polymerisation of the comonomers in aqueous emulsion in the presence of emulsifiers which render the latex stable to cement, and aggregates if present.

9. A cementing composition as claimed in claim 8 wherein at least the major amount by weight of the emulsifier is a non-ionic emulsifier.

10. A cementing composition as claimed in claim 9 wherein the non-ionic emulsifier is an alkyl phenyl ether of a polyoxyethylene glycol.

11. A cementing composition as claimed in claim 8 wherein further emulsifier is incorporated as a post-polymerisation additive.

12. A cementing composition as claimed in any one of claims 9, 10 or 11 wherein the total amount of emulsifier present ranges from 3 to 10% of the weight of the copolymer.

13. A cementing composition as claimed

in claim 12 wherein the total amount of emulsifier is about 7% by weight of the co-polymer.

14. A cementing composition as claimed in any one of the preceding claims substantially as hereinbefore described with reference to the examples.

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